

What is claimed is:

1. A surface acoustic wave device comprising:  
a plurality of surface acoustic wave elements connected  
5 in parallel, wherein each of said surface acoustic wave  
elements comprises:  
at least three interdigital transducer  
electrodes,  
wherein said interdigital transducer electrodes  
10 are operable to generate a surface acoustic wave that  
travels in a propagating direction, and wherein each of  
said interdigital transducer electrodes is formed of a  
comb shaped electrode pair;  
a first reflector electrode disposed at a first  
15 side of said interdigital transducer electrodes; and  
a second reflector electrode disposed at a second  
side of said interdigital transducer electrodes,  
wherein said first and second reflector electrodes  
are disposed in the propagating direction of the surface  
20 acoustic wave generated by said interdigital transducer  
electrodes;  
a ground connection electrode that connects together a  
first part of each comb shaped electrode pair forming said  
interdigital transducer electrodes; and  
25 a ground pad that is connected to said ground connection  
electrode.

2. The surface acoustic wave device according to

claim 1, further comprising at least one input pad and at least one output pad,

wherein a second part of each comb shaped electrode pair is connected with said at least one input pad or said at least one output pad.

3. A surface acoustic wave device comprising:

a first surface acoustic wave element and a second surface acoustic wave element, wherein each of said first and second surface acoustic wave elements comprises:

at least three interdigital transducer electrodes,

wherein each of said interdigital transducer electrodes is formed of a comb shaped electrode pair, and wherein said interdigital transducer electrodes are operable to generate a surface acoustic wave that travels in a propagation direction;

a first reflector electrode disposed at a first side of said interdigital transducer electrodes; and

a second reflector electrode disposed at a second side of said interdigital transducer electrodes,

wherein said first and second reflector electrodes are disposed in the propagating direction of the surface acoustic wave generated by said interdigital transducer electrodes;

at least one ground connection electrode, wherein, in at least one of said first and second surface acoustic wave elements, a first part of each comb shaped electrode pair

forming said interdigital transducer electrodes is connected together in common by said at least one ground connection electrode;

5 a ground pad that connects to said at least one first ground connection electrode;

a first element-to-element connection electrode, wherein a second part of a first comb shaped electrode pair in each of said first and said second surface acoustic wave elements is connected together by said first  
10 element-to-element connection electrode; and

a second element-to-element connection electrode, wherein a second part of a second comb shaped electrode pair in each of said first and said second surface acoustic wave elements is connected together by said second  
15 element-to-element connection electrode,

wherein said first and second element-to-element electrodes serially connect said first and said second surface acoustic wave elements in two stages.

20 4. The surface acoustic wave device of claim 3, further comprising a third surface acoustic wave element and a fourth surface acoustic wave element,

wherein each of said third and said fourth surface acoustic wave elements comprises a second plurality of  
25 interdigital transducer electrodes, wherein each of said second plurality of interdigital electrodes is formed of a comb shaped electrode pair,

wherein said first and said third surface acoustic wave

elements are disposed in said propagating direction of said surface acoustic wave, and are connected in parallel, and

wherein said second and said fourth surface acoustic wave elements are disposed in the propagating direction of the surface acoustic wave, and are connected in parallel.

5. The surface acoustic wave device according to claim 4, further comprising at least one input pad and at least one output pad,

10 wherein a second part of at least one comb shaped electrode pair is connected with said at least one input pad or said at least one output pad.

6. The surface acoustic wave device of claim 5, wherein, in at least one of said third and fourth surface acoustic wave elements, a first part of each comb shaped electrode pair forming said interdigital transducer electrodes is connected together in common by said ground connection electrode, and

20 further comprising:

a third element-to-element connection electrode, wherein a second part of a first comb shaped electrode pair in each of said third and said fourth surface acoustic wave elements is connected together by said third element-to-element connection electrode;

25 a fourth element-to-element connection electrode, wherein a second part of a second comb shaped electrode pair in each of said third and said fourth surface acoustic wave

elements is connected together by said fourth  
element-to-element connection electrode; and

wherein said third and fourth element-to-element  
electrodes serially connect said third and said fourth surface  
5 acoustic wave elements in two stages.

7. The surface acoustic wave device of claim 1, wherein  
said plurality of surface acoustic wave elements share  
in common one of said first reflector electrode and said second  
10 reflector electrode.

8. The surface acoustic wave device of claim 6, wherein  
said first and said third surface acoustic wave elements  
share in common one of said first reflector electrode and said  
15 second reflector electrodes.

9. The surface acoustic wave device of claim 1,  
wherein at least one of said first and second reflector  
electrodes is formed of a plurality of strip electrodes and a  
20 bus bar electrode, and

wherein different gaps are provided between different  
adjacent pairs of said strip line electrodes.

10. The surface acoustic wave device of claim 3,  
25 wherein at least one of said first and second reflector  
electrodes is formed of a plurality of strip line electrodes  
and a bus bar electrode, and

wherein different gaps are provided between different

adjacent pairs of said strip line electrodes.

11. The surface acoustic wave device of claim 4,  
wherein at least one of said first and second reflector  
5 electrodes is formed of a plurality of strip line electrodes  
and a bus bar electrode, and

wherein different gaps are provided between different  
adjacent pairs of said strip line electrodes.

10 12. The surface acoustic wave device of claim 9, wherein  
said bus bar electrode comprises a first region and a  
second region, and

said gap between respective strip line electrodes is  
different in said first and said second region.

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13. The surface acoustic wave device of claim 10, wherein  
said bus bar electrode comprises a first region and a  
second region, and

said gap between respective strip line electrodes is  
20 different in said first and said second region.

14. The surface acoustic wave device of claim 11, wherein  
said bus bar electrode comprises a first region and a  
second region, and

25 said gap between respective strip line electrodes is  
different in said first and said second region.

15. The surface acoustic wave device of claim 9, wherein

said gap between respective strip line electrodes is different throughout an entire width of said bus bar electrode.

16. The surface acoustic wave device of claim 10, wherein  
5       said gap between respective strip line electrodes is different throughout an entire width of said bus bar electrode.

17. The surface acoustic wave device of claim 11, wherein  
10       said gap between respective strip line electrodes is different throughout an entire width of said bus bar electrode.

18. The surface acoustic wave device of claim 1, wherein  
at least one of said first and second reflector  
electrodes is formed of a plurality of strip line electrodes  
15   and a bus bar electrode,  
      said bus bar electrode comprises a plurality of regions,  
      substantially identical gaps are formed between each  
adjacent pair of strip line electrodes, and  
      lengths of the respective strip line electrodes are  
20   different in said plurality of regions.

19. The surface acoustic wave device of claim 3, wherein  
at least one of said first and second reflector  
electrodes is formed of a plurality of strip line electrodes  
25   and a bus bar electrode,  
      said bus bar electrode comprises a plurality of regions,  
      substantially identical gaps are formed between each  
adjacent pair of strip line electrodes, and

lengths of the respective strip line electrodes are different in said plurality of regions.

20. The surface acoustic wave device of claim 4, wherein  
5 at least one of said first and second reflector electrodes is formed of a plurality of strip line electrodes and a bus bar electrode,

said bus bar electrode comprises a plurality of regions,  
substantially identical gaps are formed between each  
10 adjacent pair of strip line electrodes, and

lengths of the respective strip line electrodes are different said plurality of regions.

21. The surface acoustic wave device one of claim 2,  
15 wherein

said interdigital transducer electrodes are structured so that said at least one input pad and said at least one output pad operate in a balanced state.

20 22. The surface acoustic wave device of claim 5, wherein said interdigital transducer electrodes are structured so that said at least one input pad and said at least one output pad operate in a balanced state.

25 23. The surface acoustic wave device of claim 6, wherein said interdigital transducer electrodes are structured so that said at least one input pad and said at least one output



pad operate in a balanced state.

24. The surface acoustic wave device of claim 1, wherein  
in a case where there are  $n$  pieces, or more, of said  
5 surface acoustic wave elements, wherein  $n$  = an integer of 2 or  
more, said interdigital transducer electrodes are structured  
so that each of said surface acoustic wave elements has an  
impedance of  $(50 \times n) \Omega$ .

10 25. The surface acoustic wave device of claim 3, wherein  
in a case where there are  $n$  pieces, or more, of said  
surface acoustic wave elements, wherein  $n$  = an integer of 2 or  
more, said interdigital transducer electrodes are structured  
so that each of said surface acoustic wave elements has an  
15 impedance of  $(50 \times n) \Omega$ .

26. The surface acoustic wave device of claim 2, wherein  
at least two of said interdigital transducer electrodes  
are connected together in common with said at least one input  
20 pad or said at least one output pad.

27. The surface acoustic wave device of claim 5, wherein  
at least two of said interdigital transducer electrodes  
are connected together in common with said at least one input  
25 pad or said at least one output pad.

28. The surface acoustic wave device of claim 6, wherein  
at least two of said interdigital transducer electrodes

are connected together in common with said at least one input pad or said at least one output pad.

29. The surface acoustic wave device of claim 3, wherein  
5 signals in said element-to-element connection electrodes are reverse-phased to each other.

30. The surface acoustic wave device of claim 3, further comprising an electrode for connecting said first  
10 element-to-element connection electrode with said second element-to-element connection electrode.

31. The surface acoustic wave device of claim 2, wherein said interdigital transducer electrodes are structured  
15 so that impedance as viewed from said input pad or said output pad, is approximately  $50\Omega$ .

32. The surface acoustic wave device of claim 3, wherein said ground connection electrode which connects together  
20 in common said first part of the comb shaped electrode pair forming each of said interdigital transducer electrodes, and said ground pad, are disposed to be symmetrical to each other.

33. The surface acoustic wave device of claim 4, wherein  
25 said ground connection electrode which connects together in common said one part of the comb shaped electrode pair forming each of said interdigital transducer electrodes, and said ground pad, are disposed to be symmetrical to each other.

34. The surface acoustic wave device of claim 1, wherein said surface acoustic wave elements are formed on a piezoelectric substrate.

5           35. The surface acoustic wave device of claim 3, wherein said surface acoustic wave elements are formed on a piezoelectric substrate.

36. The surface acoustic wave device of claim 6, wherein  
10           one of said first and said second element-to-element connection electrodes, and one of said third and said fourth element-to-element connection electrodes, oppose each other, and

            signals in said element-to-element connection  
15 electrodes that oppose each other have the same phase.

37. The surface acoustic wave device of claim 6, further comprising:

            a connection electrode which connects one of said first  
20 and said second element-to-element connection electrodes with one of said third and said fourth element-to-element connection electrodes.

38. The surface acoustic wave device of claim 6, further  
25 comprising:

            a connection electrode which connects together in common said first, second, third and fourth element-to-element connection electrodes.